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E1C

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(54) Irrigation and drainage

(57) The present invention relates to a built-up conduit containing a ground sill, and is constructed so as to make the ground sill compact. The gist thereof lies in that an obstacle such as a weir piece (4) or a baffle board (10 Figure 4) is fitted to a ground sill block (1) in such a manner that a falling stream (5) from the inlet of the block collides with the obstacle, in order to dissipate the energy of the flowing water by said obstacle (4) or (10), and thus the conduit is best suited for use as an irrigation or drainage channel.

FIG.1

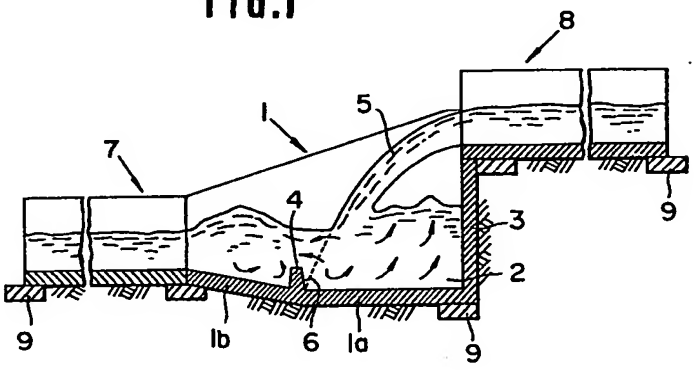

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FIG.1

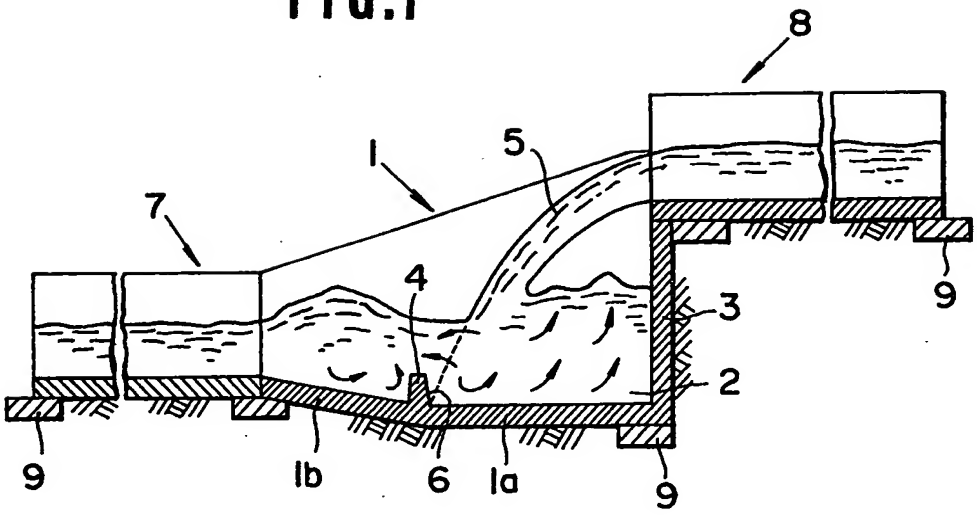

FIG.2

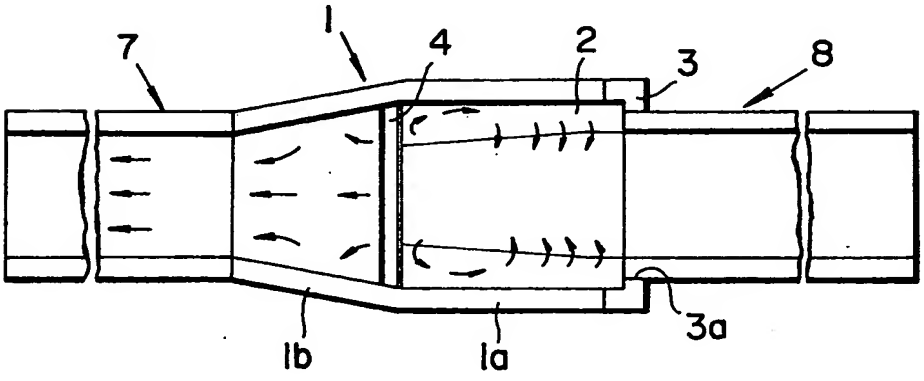

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FIG.3

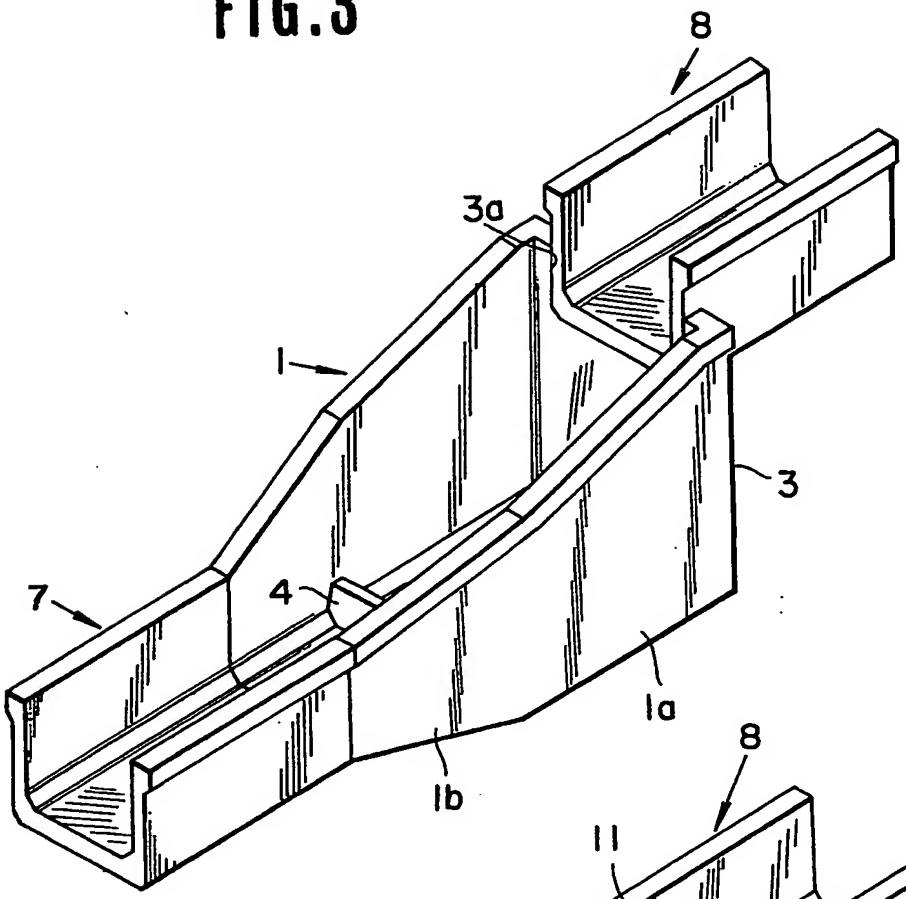

FIG.6

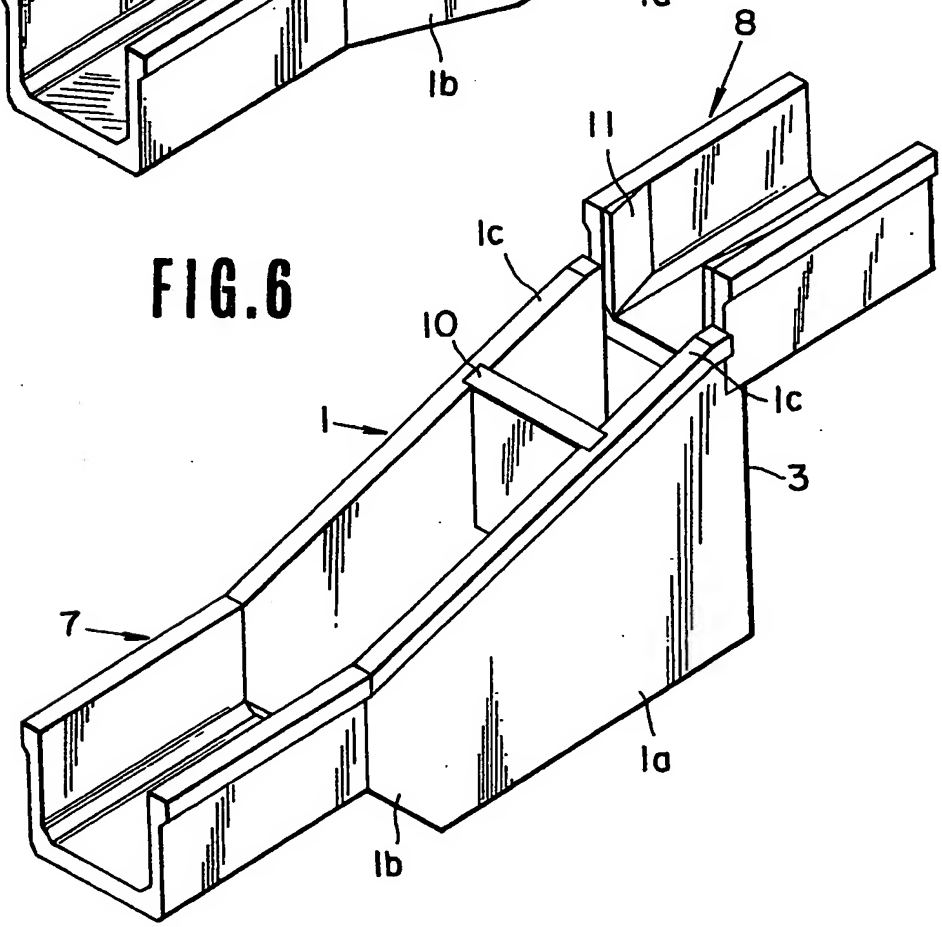

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FIG.4

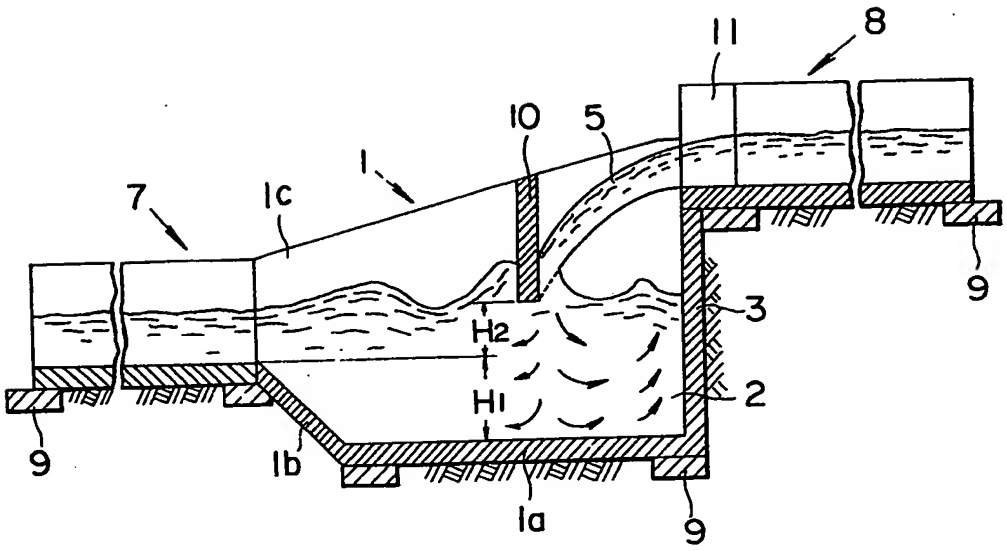
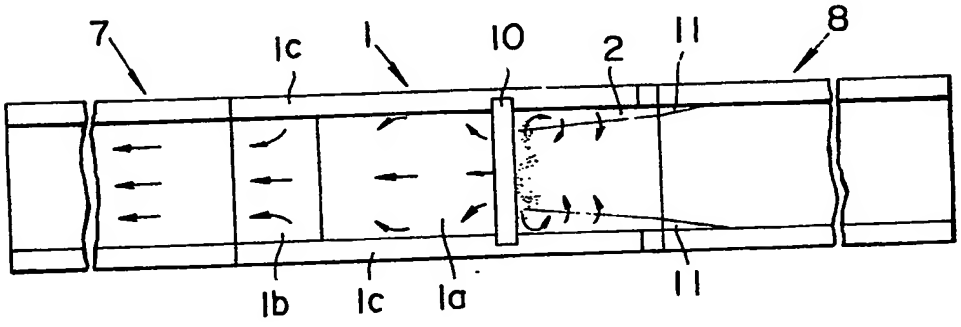


FIG.5



SPECIFICATION

Built-up conduit

Technical Field

The present invention relates to an improvement in a built-up conduit employed for irrigation and drainage channels and the like, in particular, a built-up conduit wherein a ground sill is employed to dissipate the energy of flowing water and thereby enabling the water to flow in the same state on the upstream and downstream sides, when there is a head in the place where the conduit is installed.

Background Art

Recently, accompanying improvements in the agricultural field, built-up conduits have been employed for irrigation and drainage channels. Ground sills are frequently provided in this conduit, and many ground sills can be provided, in particular, in a small-scale conduit. In this connection, it is extremely desirable to make the ground sills compact to reduce the cost and the area they occupy, etc.

Most of the ground sills so far employed are of a water cushion type, and it is a matter of common knowledge that the length of a stilling pond serving as the main component of the ground sill must be 2 or 2.5 times longer than the distance from the front end of the stilling pond to the intersection point of the extension of the line of the upper surface of the flowing water (nappe) from the starting point of intrusion of the stilling pond with the bottom surface thereof, according to the following experimental formula derived by Ishino and Izutsu:

$$\frac{X}{H} = 1.482\left(\frac{Y}{H} + 0.483\right)^{0.5842}$$

(where H is the specific energy at the limiting depth position of the stream channel; X the horizontal range of flowing water (nappe) originating from an outfall; and Y the vertical range of the nappe originating from the outfall). Said value is in accordance with a standard established for land improvement projects by the Agricultural Land Bureau of the Ministry of Agriculture and Forestry.

As a result, the shape and weight of the stilling pond inevitably become large, which results in problems in terms of price, transportation, and additional work to adjacent parts.

Although it is possible to divide the stilling pond into two or more components in this case, no problems are solved thereby other than those of transportation.

Disclosure of Invention

Accordingly, an object of the present invention is to furnish a new and improved built-up conduit containing a ground sill.

A second object of the present invention is to furnish a built-up conduit enabling the saving of material, thus being economical, facilitating the transportation and installation thereof, thereby enabling the reduction of work costs, and further diminishing the area of land occupied.

A third object of the present invention is to furnish a built-up conduit containing a ground sill enabling an effective dissipation of the energy of a falling stream.

A fourth object of the present invention is to furnish a built-up conduit in which the same blocks can be used both for the upstream and downstream conduit blocks, and which is therefore economical.

The built-up conduit constituted according to the present invention may contain the ground sill forming a stilling pond, and an upstream conduit block is connected to a downstream conduit block via this ground sill. Moreover, the ground sill can by fitted with an obstacle, and be constituted so that a falling stream from the inlet of the ground sill hits the obstacle. This obstacle is formed, for instance, of a weir piece erected on the bottom surface of the ground sill and having the same width as that of the stilling pond, or of a baffle board suspended vertically and fixed between two side walls of the ground sill. The ground sill is designed to dissipate the energy of flowing water effectively by this obstacle.

Brief Description of Drawings

Figure 1 is a longitudinal section showing a first preferred embodiment of a built-up conduit constituted according to the present invention; Figure 2 is a plan view of the embodiment of Fig. 1; Figure 3 is a perspective view from the downstream direction of Fig. 1; Figure 4 is a longitudinal section showing the second preferred embodiment of the built-up conduit; Figure 5 is a plan view of the embodiment of Fig. 4; and Figure 6 is a perspective view from the downstream direction of Fig. 4.

Best Mode of Carrying Out the Invention

This will be explained in detail below with reference to the drawings. Figures 1 to 3 illustrate one embodiment of the present invention. In these figures, numeral 1 denotes a ground sill block which consists of a pond conduit part 1a forming a stilling pond 2, and a communication conduit part 1b. The pond conduit part 1a is formed by covering completely the front end of an open conduit having a horizontal bottom and a specified width with a vertical wall 3 serving as an earth retainer, and by erecting a weir piece (obstacle) 4 having the same width as that of the stilling pond monolithically on the bottom surface of said ground sill block 1, in the vicinity of the rear end of the open conduit.

Based on the studies by the present inventors, said weir piece 4 is erected, as shown in Figure 1, in a place 6 where a falling stream 5, falling from an inlet at the upper end of the vertical wall 3 positioned at the front end of the stilling pond 2, hits the bottom of the ground sill block 1. (More correctly, the place 6 is the intersection point of

the extension of the line of said falling stream 5 with the bottom of the ground sill block 1, since the stream 5 does not actually hit the bottom of the block 1 owing to the presence of water in the stilling pond 2.)

If the weir piece 4 is erected at a position away from the place 6 toward the vertical wall 3, the falling stream 5 hits the bottom surface of said ground sill block 1 directly, thereby disturbing the flow on the downstream side markedly, and thus the block does not work as a ground sill dissipating energy. If the weir piece 4 is erected at a position away from the place 6 toward the downstream side, the falling stream 5, after hitting the bottom surface of the ground sill block 1, becomes a jet stream and flows along the wall surface of the bottom of the ground sill block 1. This jet stream hits the weir piece 4, raising the level of the stilling pond 2 considerably and also effecting the flow downstream. Therefore the erection of the piece at this position is not preferable in view of the function of the block as a ground sill dissipating energy, as is the case when the piece is erected at the above, correct position.

When said weir piece 4 is erected at said place 6, the direction of the falling stream 5 is deflected by the weir piece 4, an intensely turbulent flow is generated behind the falling stream 5, and thereby the energy thereof is dissipated. Therefore, after a slight rise in the water level, the stream can run smoothly downstream via the communication conduit part 1b.

Since the weir piece 4 is provided on the (estimated) place 6 of the collision of the falling stream 5 with the bottom surface of the ground sill block 1 in the present invention, as described above, a length nearly the same as, or slightly larger than, the distance from the vertical wall 3 to said place 6 is sufficient for the length of the stilling pond 2. Studies have also made it clear that the desirable width of said weir piece 4 is identical to the internal width of the ground sill block 1, i.e. the width of the stilling pond 2, and that the preferable height of the piece is 70% to 80% of the limiting depth of the stream running through the upstream conduit block 8, to which reference will be made later.

The communication conduit part 1b of the above ground sill block 1 is an open conduit formed in such a manner that its width and depth are reduced gradually downstream, and an open-conduit downstream conduit block 7 having a fixed width and depth is connected to the end on the downstream side thereof. Numeral 8 denotes an upstream conduit block having the same shape as that of said downstream conduit block 7, and the rear end thereof is inserted into and laid over a cut-out 3a formed in the upper end of the vertical wall 3 and having the same shape as said end of said block 8.

Each of said blocks 1, 7 and 8 are assembled and connected to each other correctly for irrigation and drainage channels by using support pieces 9 or the like, and thus the built-up conduit is constructed.

Figures 4 to 6 illustrate another embodiment of the present invention in which the same members as those of the above embodiment are indicated by the same numbers. In the present embodiment, the ground sill block 1 has the same width as that of the upstream and downstream conduit blocks 7 and 8, the depth of the stilling pond 2 is slightly larger than that of the first embodiment, and a baffle board (obstacle) 10 is suspended vertically and fixed between two side walls 1c.

As shown in Figure 4, the baffle board 10 is suspended at a position where the falling stream 5 from the outfall at the upper end of the vertical wall 3 located at the front end of the stilling pond 2 hits the baffle board 10 and flows down thereafter smoothly in the form of a vertical stream, in more detail, at a position where at least the lower surface of the falling stream hits the board when water is flowing in its maximum design quantity. The provision of such a baffle board 10 makes it possible to make the length of the stilling pond 2 about 1/2 that of a conventional one, and also make the rise angle of the communication conduit part 1b between 30° to 45° when the maximum design quantity of water is flowing.

Experiments confirm that the depth H_1 of said stilling pond 2 can be about 2.0 to 2.5 times larger than that of the design standard proscribed by the land improvement works project made by the Agricultural Land Bureau of the Ministry of Agriculture and Forestry. The interval H_2 between the bottom surface of the downstream conduit block 7 and the lower end of the baffle board 10 can be the same as the limiting depth (the depth when the maximum design quantity of water is flowing) in the upstream conduit.

Numeral 11 denotes haunches which are provided near the rear end of the upstream-side conduit block 8 so as to narrow the width of the conduit in this region gradually, and thereby control the negative pressure generated behind the falling stream 5.

According to the present embodiment, the falling stream 5 hits the baffle board 10 and flows down into the stilling pond 2 in the form of a vertical stream along the board, the energy thereof is dissipated effectively by the water cushion in the stilling pond 2, and after a slight rise in the water level, the water flows downstream through the communication conduit 1b.

In the present invention with the constitution described above, the falling stream 5 hits an obstacle such as the weir piece 4 or the baffle board 10 and thereby the energy of the stream is dissipated effectively. The length of the stilling pond 2 needs to be only 1/2 to 1/2.5 that of a conventional one. Accordingly, the materials are reduced, which makes the present embodiment economical. In addition, this makes the embodiment convenient for transportation and installation, enabling a large reduction of the costs therefor. Moreover, the area of land occupied thereby can be reduced.

Furthermore, the embodiment has other effects in that the value of the block as a ground sill

dissipating energy is much increased, and that it is extremely economical in terms of production, transportation, installation, etc., since the same block can be used both for the downstream and upstream conduit blocks 7 and 8.

The foregoing is a description of preferred embodiments of the present invention, and it will be easy for persons skilled in the art to understand that a number of alterations and modifications can be applied to these embodiments without departing from the true spirit and coverage of the present invention.

CLAIMS

1. In a built-up conduit wherein a stilling pond is formed using a ground sill and wherein conduit blocks on the upstream and downstream sides of the ground sill are connected to each other through the intermediary of said ground sill, a built-up conduit characterized in that an obstacle is fitted to the ground sill so that a stream falling from the inlet of the ground sill work hits the obstacle.

2. The built-up conduit according to Claim 1, which is characterized in that a weir piece having the same width as that of the stilling pond is erected as the obstacle on the bottom surface of the ground sill, at the place at which the falling stream hits the bottom surface.

3. A built-up conduit characterized in that a baffle board is suspended vertically and fixed as the obstacle between two side walls of the ground sill so that the falling stream hits said baffle board.

4. A built-up conduit substantially as hereinbefore described with reference to and as shown in Figures 1—3 or in Figures 4—6.

5. Any novel integer or step, or combination of integers or steps, as hereinbefore described and/or as shown in the accompanying drawings, irrespective of whether the present claim is within the scope of, or relates to the same or a different invention from that of, the preceding claims.

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